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Swati Nawani¹, Krishnendu Banerjee¹, Abhijit Das^{1*}

¹Endangered Species Management Department, Wildlife Institute of India, Dehradun-248001, Uttarakhand, India

*Corresponding author: abhijit@wii.gov.in

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A note on the larval stage of the Sikkimese caecilian, *Ichthyophis sikkimensis* Taylor, 1960

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KEYWORDS. Caecilian, Developmental stages, Transitory stage, Sensory tentacles, Nuchal collars, Tail fin, Annuli

Among the three modern amphibian orders, Gymnophiona (caecilians) are the least known (Zhang & Wake 2009). Caecilians are readily distinguished from members of Anura (frogs and toads) and Caudata (salamanders and newts) by their elongated, annulate and limbless bodies. Gymnophiona are found in the moist tropical and proximate temperate regions of South-east and South Asia, Africa, the Seychelles, Cen-

tral and South America (Zhang & Wake 2009). Among the 215 currently recognised extant species under 10 families, the genus *Ichthyophis* is the most speciose, with 50 species (April 10, AmphibiaWeb 2022)

The Sikkimese caecilian, *Ichthyophis sikkimensis* Taylor, 1960, was described on the basis of a holotype and three paratypes from the Indian states of Sikkim and West Bengal. The species is known to occur in Sikkim and Darjeeling regions of West Bengal and the Ilam district of eastern Nepal (Taylor 1960; Sarkar et al. 1992; Pillai & Ravichandran 1999; Anders et al. 2002; Shah & Tiwari 2004; Kamei et al. 2009; Kamei 2017; Frost et al. 2022). *Ichthyophis sikkimensis* is classified as Data Deficient (DD) in the IUCN Red list of Threatened species because of “ongoing uncertainties as to its extent of occurrence, status and ecological requirements” (Ohler et al. 2004).

During a field survey conducted between 15-21 July, 2021 at Kalikhola Latpanchar, Darjeeling district, West Bengal State, a caecilian was found while searching for earthworms under wet stones on sandy-gravel substratum beside a running stream inside a forest at Kalikhola (26° 44' 34" N, 88° 34' 22" E). The specimen was collected by Md. Nurul Hassan on 19.07.2021 on a rainy day during peak monsoon season and euthanised by injecting 70% ethanol into the heart, then washed with water and preserved for two days in 4% formaldehyde solution. Later it was washed in running tap water and transferred to 70% ethanol for final preservation and deposited in the collections of the Zoological Survey of India as ZSI A 15401. The specimen was identified as a larva of *Ichthyophis* because of the presence of a spiracle and tail fin and also because the tentacle had not erupted. There are no published keys to ichthyophiid larvae, but the specimen is tentatively identified as *I. sikkimensis* (Taylor 1960) because it is a late-stage larva that lacks lateral yellow stripes. Measurements were taken with a Mitutoyo™ digital calliper to the nearest 0.1 mm under a Leica EZ4 stereo binocular microscope and a Lensel magnanoscopescope.

The developmental stages of *Ichthyophis sikkimensis* is poorly known, with no published description of the larvae. For the first time, we present information on the larval morphology

Table 1. Morphometric and meristic data for the larvae of *Ichthyophis sikkimensis* from Darjeeling district, West Bengal. Measurements to the nearest 0.01 mm.

Characteristics	ZSI A 15401	ZSI 19049 A	ZSI 19049 B	ZSI 19049 C
Snout to vent length	120.0	144.0	131.0	103.0
Tail length	2.3	1.1	2.2	Damaged
Head length	4.0	3.0	3.4	3.1
Head width	4.2	3.9	3.5	3.4
Snout length	3.1	2.1	2.4	2.3
Eye to nostril distance	2.0	1.9	2.0	2.0
Eye to corner of mouth	1.6	1.1	1.5	1.6
Nostril to snout tip distance	1.2	0.4	0.7	0.6
Inter-narial distance	2.0	1.5	1.9	1.6
Inter-orbital distance	3.1	3.2	2.3	2.3
1 st nuchal groove distance from the tip of the snout	7.1	6.9	8.4	6.3
2 nd nuchal groove distance from tip of the snout	8.9	10.1	10.1	8.5
Anterior tip of the vent to the tail tip	4.1	2.8	3.7	Damaged
Distance between two annuli on the dorsal part of the body	0.9	0.4	0.5	0.4
Length of the cloacal slit	1.3	1.1	1.5	1.1
No. of Annuli	287	286	286	275
Tail structure	Tail tip more rounded, tail fin less broad, curved dorsally	Tail tip more rounded, tail fin less broad	Tail tip more rounded, tail fin less broad	Tail tip more rounded, tail fin less broad
Gill structure	Not elongated, small pin-head shaped, not deep opening	Elongated, deep opening	Elongated, deep opening	Elongated
Mechanosensory organs on mandible	Thick white dots with small central grooves, considerably larger and circumscribed by a dark circular groove	Thick white dots	Thick white dots	Thick white dots
Nasal opening	Triangular shaped, frontal nasal opening	Circular shaped, frontal nasal opening	Circular shaped, frontal nasal opening	Circular shaped, frontal nasal opening
Glandular papillae	Present on chin	Absent	Absent	Absent

of *I. sikkimensis* along with a brief comparison with the juvenile of *Ichthyophis kohtaoensis* (Dünker et al. 2000) and late larval stage and juvenile of *Ichthyophis glutinosus* (Breckenridge et al. 1987). The head of ZSI A 15401 is flattened, snout rounded in front, the mouth has well-developed labial folds typical of ichthyophiid larvae. The small eyes are covered with semi-transparent skin. Breckenridge et al.

(1987) reported that the gills of hatchlings of *I. glutinosus* fall off just two days after hatching. ZSI A 15401 lacks any sign of gills, and a single spiracle is visible on each side laterally just behind the head (Figure 1a). Sensory tentacles have not yet erupted. Mechanoreceptive sense organs on the head are visible as minute white spots. Two partially developed collars are visible on the ventral side only (Figure 1b). A short



Figure 1. *Ichthyophis sikkimensis* larvae ZSI A 15401 from Kalikhola, Latpanchar, Darjeeling district, West Bengal (26° 44' 34" N, 88° 34' 22" E). a. Lateral view of head, b. Ventral view of head, c. Lateral view of the tail fin, d. Ventral view of the tail fin.

laterally compressed tail fin is present (Figure 1c & d) In *I. glutinosus*, the transition from late larval to “juvenile” stage is marked by the gradual disappearance of the tail fin (Breckenridge et al. 1987). The annular folds of the skin are not clearly demarcated, making a count of the folds very difficult, as is typical of ichthyophiid larvae (e.g., Breckenridge et al. 1987). In ZSI A 15401 the number of annuli is approximately 287. Snout-vent length is 120 mm and tail length is 2.3 mm.

After studying the specimen, we have come to the conclusion that ZSI A 15401 is in the stage 38 of Dünker et al. (2000) because mechanosensory organs are present on the mandible as thick white dots with small central grooves, considerably larger and circumscribed by a dark circular groove; glandular papillae present on the chin; triangular shaped, frontal nasal opening; tail tip

more rounded, tail fin less broad, curved dorsally. Therefore, we conclude that due to absence of gills (which is regressed forming only a tiny aperture), presence of a reduced tail fin and yet absence of any sensory tentacles, this specimen is in a transitory stage between the late larva and small metamorphosed stage of *Ichthyophis sikkimensis*.

We also examined three previously collected larvae (ZSI 19049A, B, C) from Darjeeling district of West Bengal state, India by S.W. Kemp in 1918 (Pillai & Ravichandran 1999). These larvae are in the stage 37 of Dünker et al (2000) because mechanosensory organs are present on the mandible as thick white dots; gills are stripped off, no external gills and opening to gill chambers are deep and elongated; tail tip more rounded than arrow-shaped, tail fin less broad and no longer delineated.

Although Pillai & Ravichandran (1999) also mentioned ZSI 19334 and ZSI 19335 as larvae of *Ichthyophis sikkimensis* collected by F.M. Bailey (“Barley” in Pillai & Ravichandran [1999]) from Gangtok, Sikkim on 23.i.1922, we however found that ZSI 19334 is an adult while ZSI 19335 is probably lost. Further collections and comparative studies of different developmental stages of *I. sikkimensis* will enhance our knowledge about the life history of this interesting caecilian in future.

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Sonia Mondal^{1*}, Sweta Bhattacharya^{1*} & Kaushik Deuti¹

¹Zoological Survey of India, Herpetology
Division, FPS Building, Indian Museum
Complex, 27 JL Nehru Road, Kolkata –
700016

Corresponding authors *swetab2110@gmail.
com, *soniamondal680@gmail.com

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**A report on ophiophagy observed
in *Naja oxiana* (Eichwald 1831)
from Himachal Pradesh, India**

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KEYWORDS. Elapidae, diet, Himalayas, *Elaphe*
hodgsoni, Serpentes

The central Asian cobra *Naja oxiana* (Eich-
wald 1831) is a species of venomous snake in
the family Elapidae that ranges from the Tran-
scaspian region of central Asia all the way down
to India (Smith 1943; Wall 1911; Wüster &
Thorpe 1992; Wallach et al. 2009). The pres-
ence of *Naja oxiana* in Himachal Pradesh was
recently confirmed by Santra et al. (2019). De-
spite a seemingly wide distribution, there is a
broad gap in our knowledge of the natural his-
tory of the species. There are no published re-
cords of its dietary composition, except a broad
mention that it feeds on amphibians, lizards, and
small rodents (Whitaker & Captain 2008). Here
we present the first verified observations to our
knowledge of ophiophagy in *Naja oxiana*.

The first instance was observed in Jukyani
village (32°51'32"N, 76°08'41"E, 1624 m
a.s.l.), situated in Chamba district of Himachal
Pradesh. On 7 July 2020 at 17:25 h, a *Naja ox-*
iana was found in a villager's house during a
rescue operation. The snake measuring a total
length of ca. 119 cm was observed feeding on

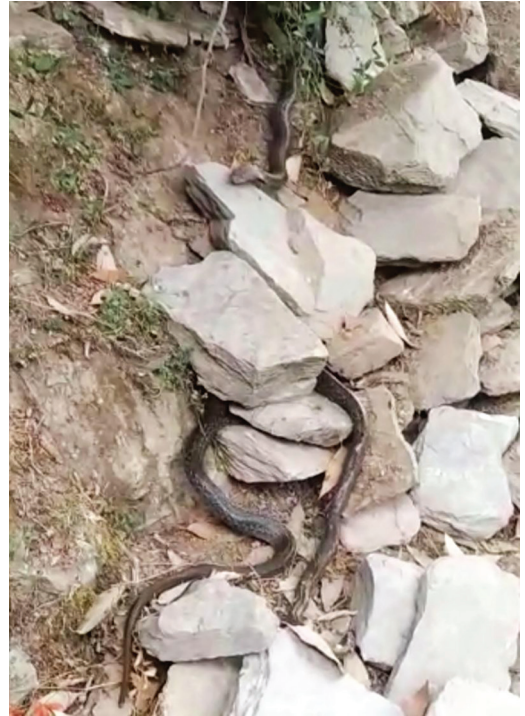


Figure 1. *Naja oxiana* returning to the dead *Elaphe hodgsoni*.

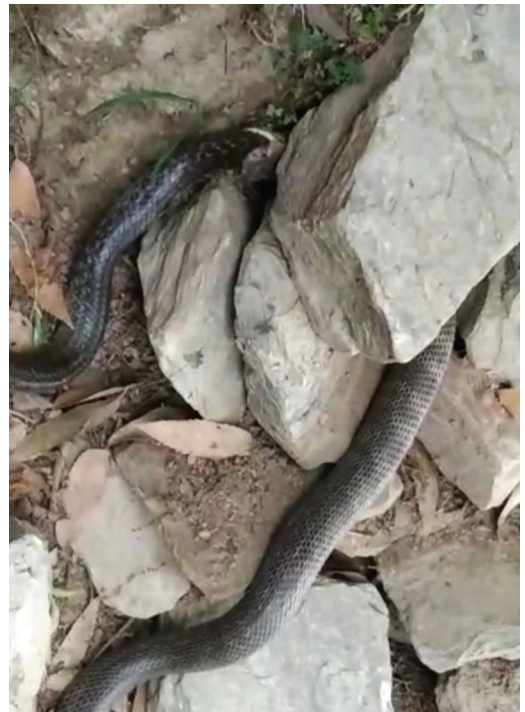


Figure 2. *Naja oxiana* feeding on *Elaphe hodgsoni*.